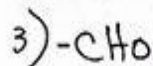
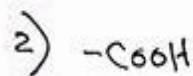
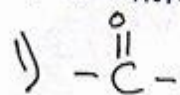
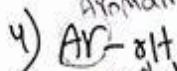


Identification of Organic Compound

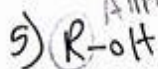
* Functional group:-



Aromatic group



Aliphatic group



Type of Compound

Ketone

Acid

Aldehyde

Phenol

Alcohol

* Physical Properties:-

Color:

Shape:

Solubility:- For solids \Rightarrow Solubility in H_2O
For liquids \Rightarrow Miscibility with H_2O

\swarrow Miscible in H_2O

\searrow Immiscible in H_2O

* Identification of Alcohols

* Alcohol :- organic compound in which (-OH) group is directly attached to an aliphatic part (R-OH)

Classification of Alcohols according to the no. of (-OH) groups:-

1] Monohydric Alcohol \Rightarrow CH_3OH Methanol $\text{CH}_3\text{CH}_2\text{OH}$ ethanol

2] dihydric Alcohol \Rightarrow $\begin{array}{c} \text{CH}_2\text{-OH} \\ | \\ \text{CH}_2\text{-OH} \end{array}$ ethylene glycol.

3] trihydric Alcohol \Rightarrow $\begin{array}{c} \text{CH}_2\text{-OH} \\ | \\ \text{CH-OH} \\ | \\ \text{CH}_2\text{-OH} \end{array}$ Glycerol

B

* Physical Properties :-

* Color \Rightarrow Colorless

* Shape \Rightarrow liquid

* ~~Partial~~ Miscibility with $H_2O \Rightarrow$ Miscible in H_2O

2 Chemical Properties

[a] oxidation reaction

□ esterification reaction

[3] Iodoform reaction

[a] oxidation reaction

$$R-CH_2-OH \text{ } 1^\circ \text{ alcohol}$$
$$\begin{array}{c} R \\ | \\ R-CH-OH \end{array} \quad 2^\circ \text{ alcohol}$$
$$\begin{array}{c} R \\ R \\ R \end{array} \text{---} C \text{---} OH \quad 3^\circ \text{alcohol}$$

Primary and 2° alcohol are only oxidized but 3° alcohol not, due to absence of hydrogen.

$$1^\circ \text{alcohol} \Rightarrow \text{R}-\text{CH}_2-\text{OH}$$
$$2^\circ \text{ alcohol} \Rightarrow \begin{array}{c} R \\ | \\ R - C - CH - OH \end{array}$$


3° alcohol \Rightarrow no reaction

$\xrightarrow{[O]} R-CHO \xrightarrow{[O]} RCOOH$
 Aldehyde Acid
 $\xrightarrow{[O]} R_2C=O$ Ketone

$$R-C(=O) \text{ Ketone}$$

طريقة التفرقة بين انواع الكربونات

Procedure:-


 drops of conc H_2SO_4 .
 0.5 ml of $\text{K}_2\text{Cr}_2\text{O}_7$ (orange)
 0.5 ml of alcohol

obs.

orange $\xrightarrow{\text{convert to}}$ green.

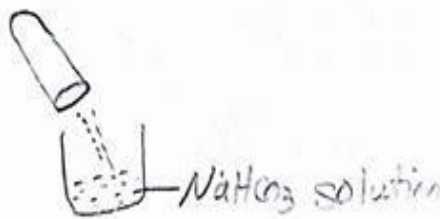
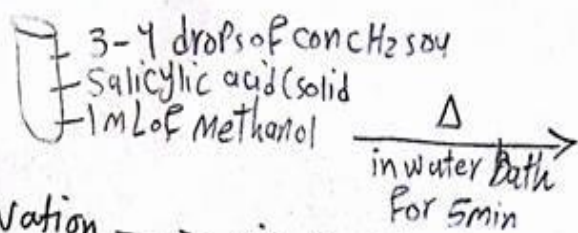
$$* \text{CH}_3\text{OH} + \text{K}_2\text{Cr}_2\text{O}_7 \xrightarrow[\text{conc}]{\text{H}_2\text{SO}_4} \underset{\text{Formaldehyde}}{\text{HCHO}} + \text{K}_2\text{SO}_4 + \underset{(\text{Green})}{\text{Cr}_2(\text{SO}_4)_3}$$
$$\times \text{CH}_3\text{CH}_2\text{OH} + \text{K}_2\text{Cr}_2\text{O}_7 \xrightarrow{\text{conc H}_2\text{SO}_4} \text{CH}_3\text{CHO} + \text{K}_2\text{SO}_4 + \text{Cr}_2(\text{SO}_4)_3$$

ethanol Acetaldehyde

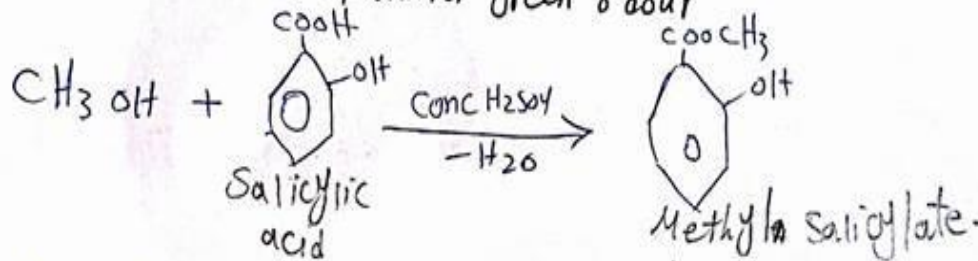
2

D) esterification reaction :- reaction between Alcohol and an acid to give ester + water

Procedure :- For Methanol

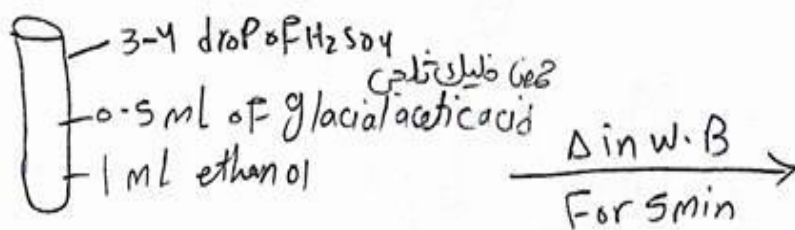


Observation \rightarrow oil of winter green odor

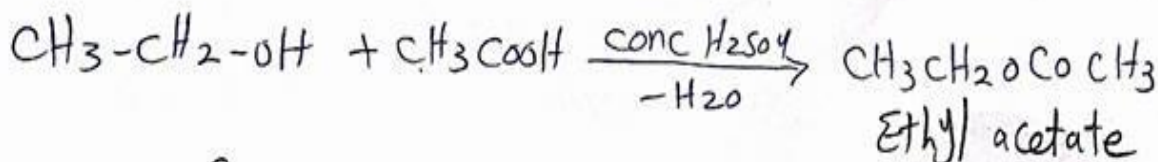


طريقة أخرى للتفريق بين الميثانول والبنزوات

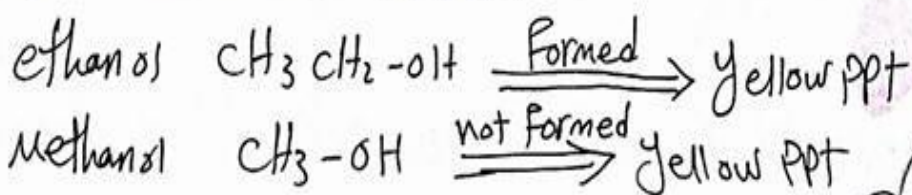
Procedure for ethanol :-



Observation Fruity odor



[E] Iodoform reaction :- Iodide compound formation CHI_3 \downarrow yellow ppt
Iodoform reaction occurs with alcohols that contain free methyl group attached to α -carbon.



طريقة أخرى للتفريق بين الإيثانول والميثانول

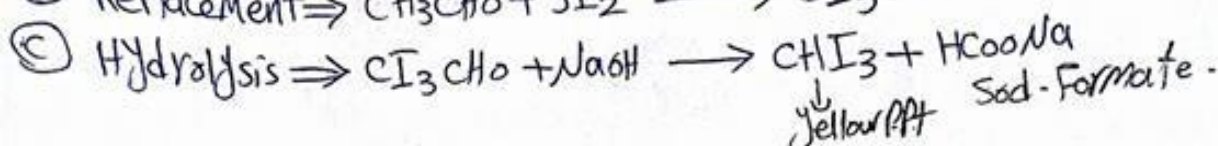
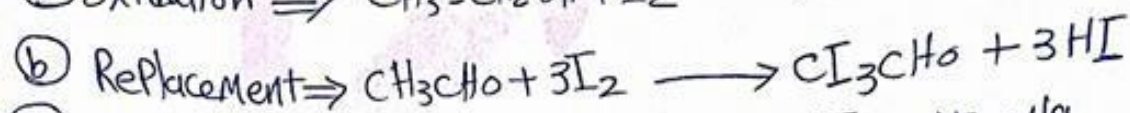
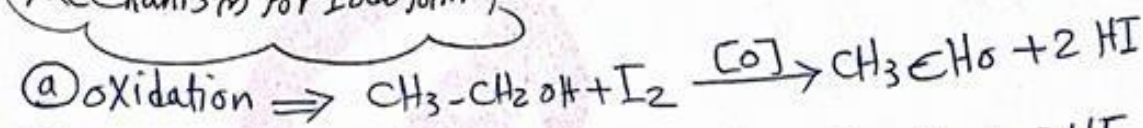
Reagents:

add NaOH solution drop by drop with shaking till yellow color
6ml I₂ solution (dark brown)
1ml ethanol

$\xrightarrow[\text{in w.B for 15 min}]{\Delta}$

Cooling \Rightarrow Yellow PPT

Mechanism for Iodoform



Identification of Hydrocarbon

* Organic compounds that contain C, H only.



Naphthalene



Anthracene

Physical Properties :-

Color :- (1) white (colorless)

(2) colorless (white) or faint yellow

Shape :- crystal

Solubility in H₂O \Rightarrow insoluble in H₂O

Chemical Properties

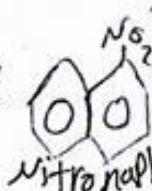
[1] Nitration test (Test of aromaticity)

0.5ml of HNO₃ conc
0.5ml of conc H₂SO₄
organic solid

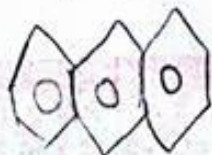
$\xrightarrow{\Delta}$ Warm on flame till evolution of reddish brown vapour



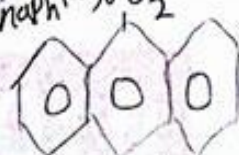
conc H₂SO₄
conc HNO₃



Nitronaphthalene



conc H₂SO₄
conc HNO₃

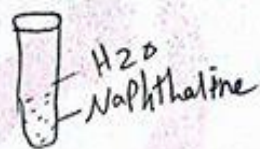


Nitroanthracene

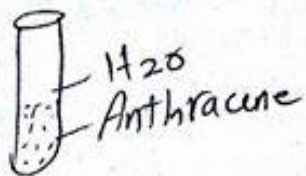
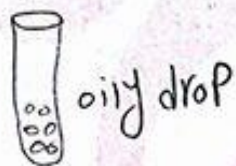


H₂O (Positive)
any color or any ppt
or any oily drops

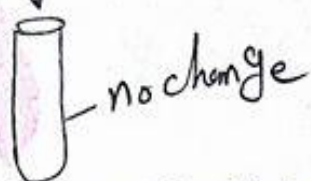
② Action of heat



Δ boil



Δ boil



- * Melting Point of Naphthalene $<$ BP of water, So it melt and form oily drops
M.P. of Naphthalene = $76^\circ C$
- * M.P. of Anthracene $>$ B.P. of water, So No change occurs
M.P. of Anthracene = $200^\circ C$

Identification of Phenol

Phenol :- An organic compound in which $(-OH)$ group is directly attached to Aromatic group.

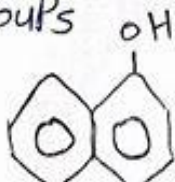
* Classification of Phenol

(I) According to the no. of $(-OH)$ groups

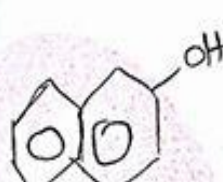
(a) Monohydric Phenol



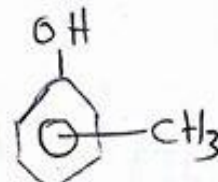
Phenol



α -Naphthol

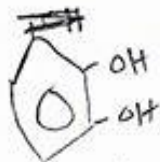


β -Naphthol

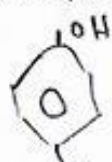


Cresol

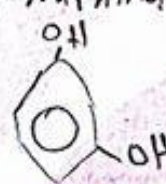
(b) Dihydric Phenol



Catechol

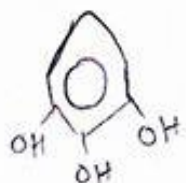


Resorcinol

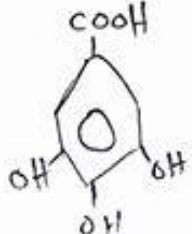


Hydroquinone

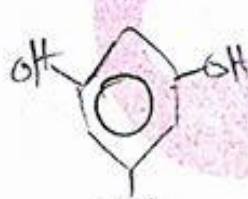
(c) Trihydric Phenol



Pyrogallol



Gallic acid



Phloroglucinol

2] according to solubility in H_2O

① water soluble Phenols \Rightarrow All Di / All trihydric Phenols are water soluble in addition to Phenol because its m.wt is small

Solubility \propto no. of $(-OH)$
 $\propto \frac{1}{m.wt}$

② water insoluble Phenols \Rightarrow All Mono hydric Phenols are water insoluble except Phenol.

* Physical Properties

① Shape :- All Phenols are solids except Phenol

Pure (solid crystal) impure (liquid)

② color : all Phenols are color except Phenol

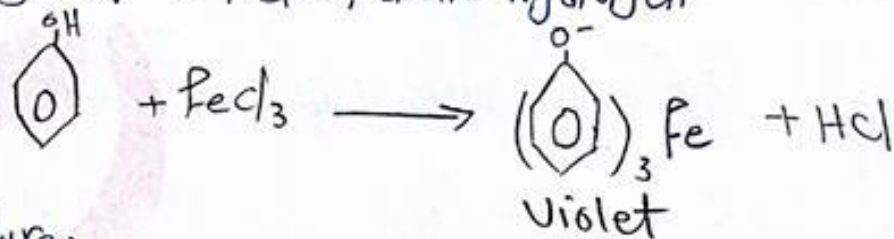
Pure (colorless)
 impure (red)

③ solubility in water

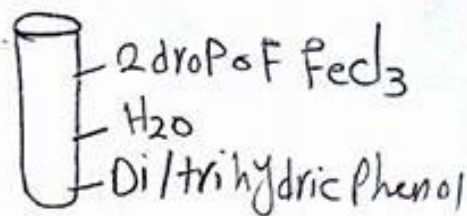
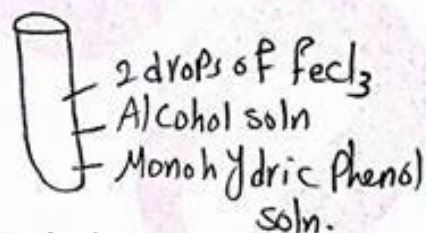
chemical Properties

Compound Test	Phenol	α -Naphthol	β -Naphthol	Catechol	Resorcinol	Hydroquinone	Pyrogallol
$FeCl_3$ Test	Violet color	Brown color excess $FeCl_3$ \downarrow violet	Pale green color excess $FeCl_3$ \downarrow violet	green color	Violet color	green ppt	red color
Phthalin test	Pink color	Pale green color	Pale green Fluorescence	Blue color	reddish solution + green Fluorescence	Blue violet color	-ve
Azodye test	scarlet red ppt	reddish brown ppt	scarlet red ppt	-ve	deep red ppt	-ve	-ve

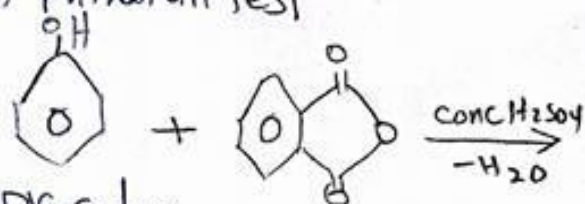
[1] $FeCl_3$ Test :- Test of Phenolic hydrogen



Procedure:-

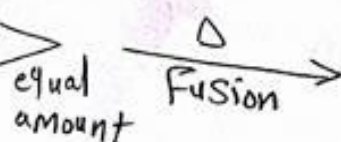
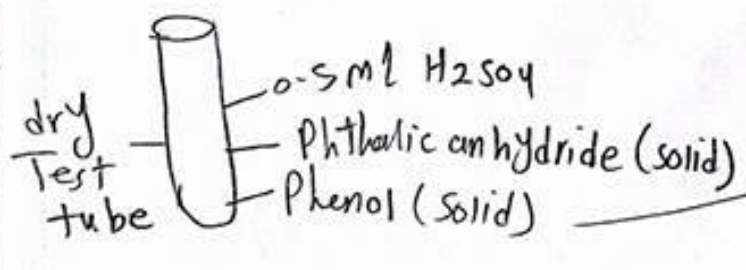


[2] Phthalic Test



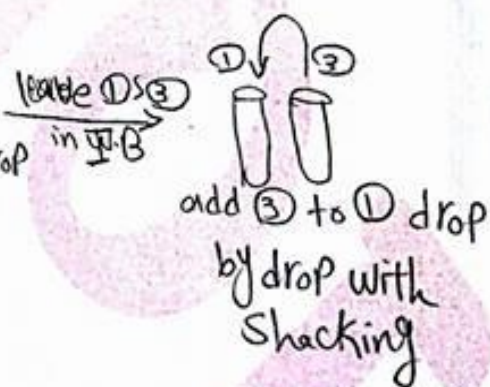
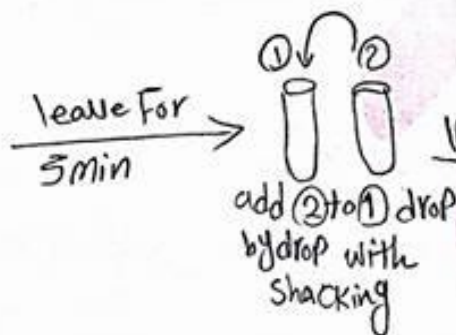
Procedures:-

Ph-Ph in acidic med.



[3] Azodye Test

Procedure



① 0.5 ml aniline
+ 3 ml H_2O
+ 1 ml conc HCl

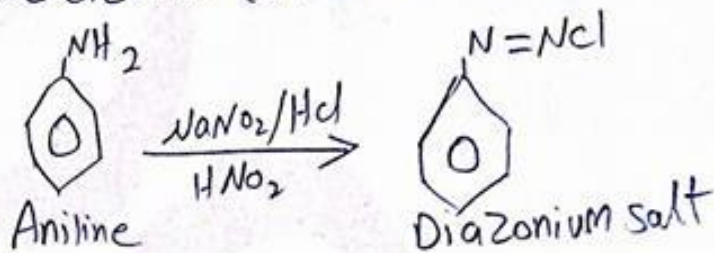
② $NaNO_2$ solution (نیتروکسید سولوشن)

③ $NaOH$ solution
+ Phenol (solid)

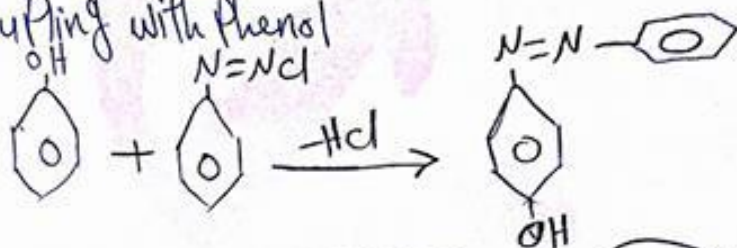
[7]

Mechanism of azodye:-

① Diazodization (Formation of diazonium salt)



② Coupling with Phenol



Identification of Acids

Carboxylic acid \Rightarrow organic compound contain $(-\text{COOH})$

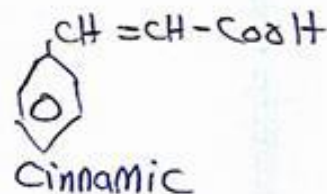
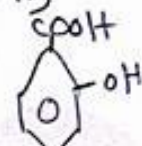
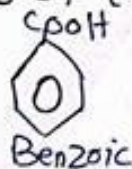
* organic acid are weak ($\text{CH}_3\text{COOH} \rightarrow \text{CH}_3\text{COO}^- + \text{H}^+$)

* Classification of acids according to No. of $(-\text{COOH})$

① Mono

HCOOH
Formic

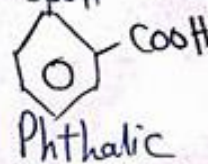
CH_3COOH
Acetic



② Di

HOOC-COOH
Oxalic

HO-CH-COOH
 HO-CH-COOH
Tartaric



③ Tri

$\text{CH}_2\text{-COOH}$
 HO-C-COOH
 $\text{CH}_2\text{-COOH}$

Citric acid

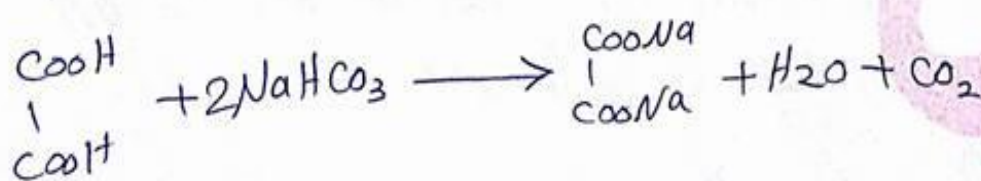
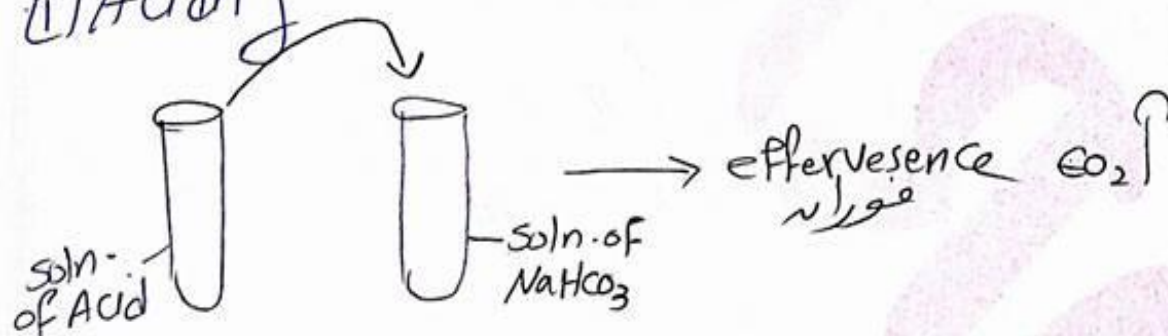
* classification according to type:-

① Aliphatic \Rightarrow Formic, Acetic, Oxalic, tartaric, citric

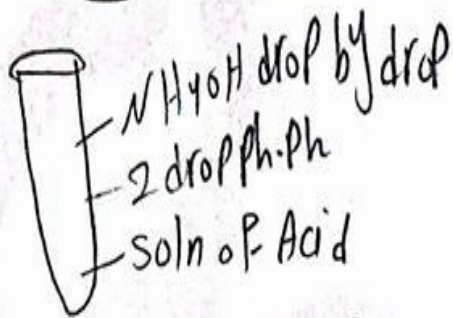
② Aromatic \Rightarrow Benzoic, salysalic, Phthalic, cinnamic

Test	Formic	acetic	oxalic	tartaric	citric
Acidity	eff	eff	eff	eff	eff
N.S + FeCl ₃	red brown	red brown	-ve	-ve	-ve
N.S + FeCl ₂	-ve	-ve	white ppt at once	white ppt after scratching	white ppt after boiling
KMnO ₄	decolorized	-ve	Dicolorization		
Solid + H ₂ SO ₄	-ve	-ve	No reaction (clear)	black	yellow
Fenton's Test	-ve	-ve	-ve	violet	-ve
Denge's Test	-ve	-ve	-ve	-ve	Dicolorization

Acidity

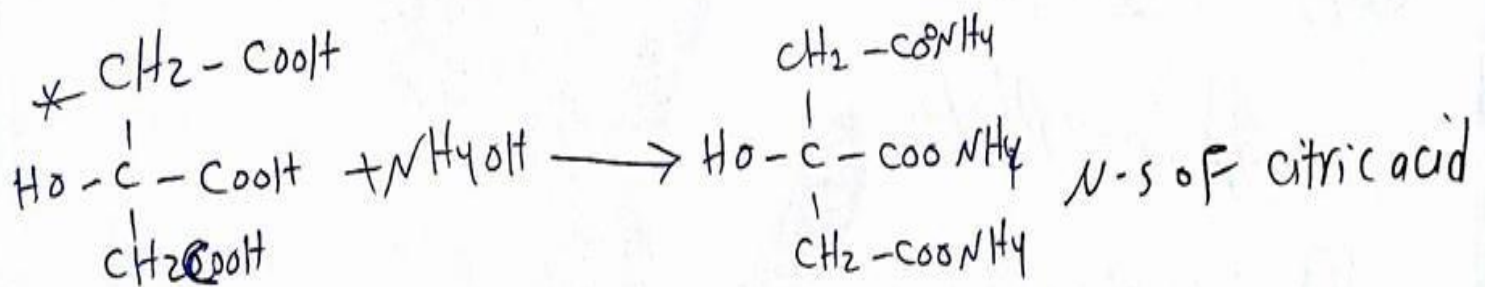
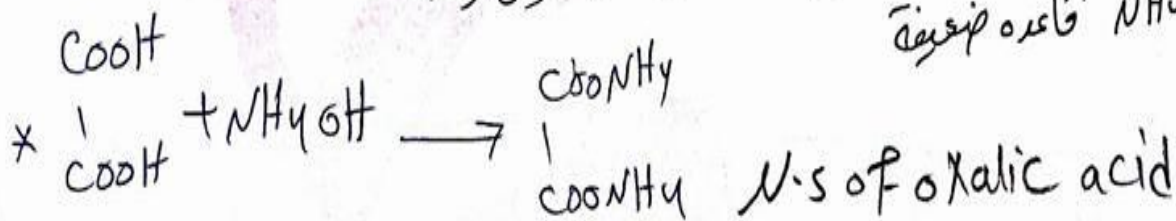


* Neutral Soln.

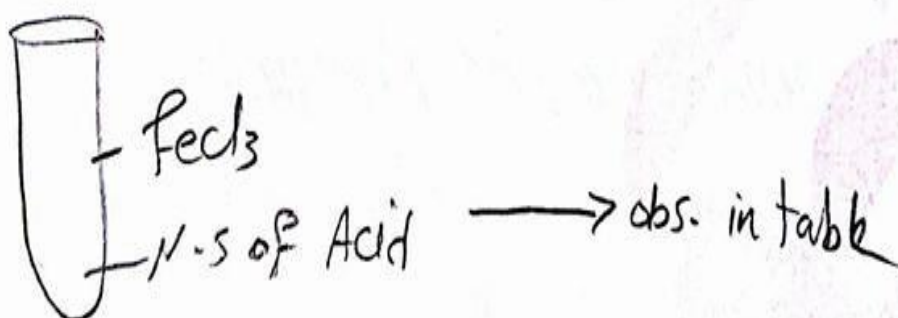


Colorless \rightarrow Faint Pink $\xrightarrow{\Delta}$ Colorless $\xrightarrow{\text{cooling}}$ colorless


علل) نستخفم NH₄OH بدل من NaOH
لأنه NaOH قاعده قويه معروفه أن تخلص من الفوسفور زياده
اما NH₄OH قاعده ضعيفه

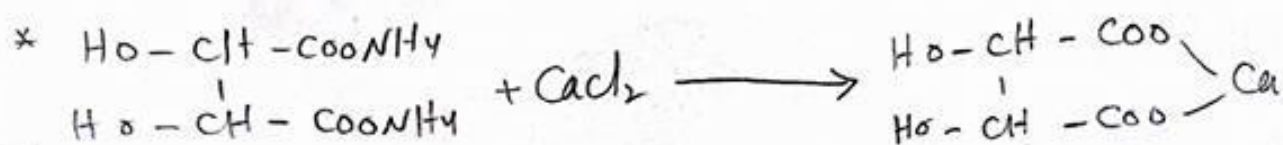
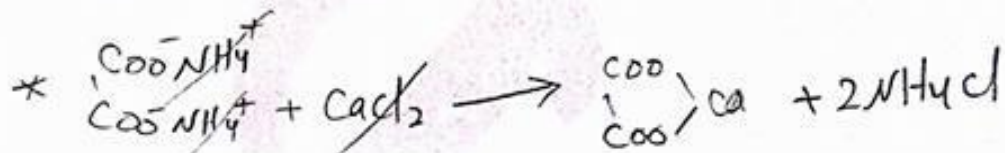
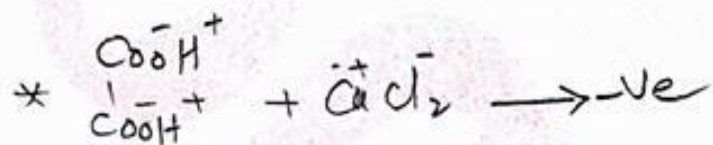


[2] N.s + FeCl₃

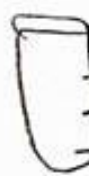


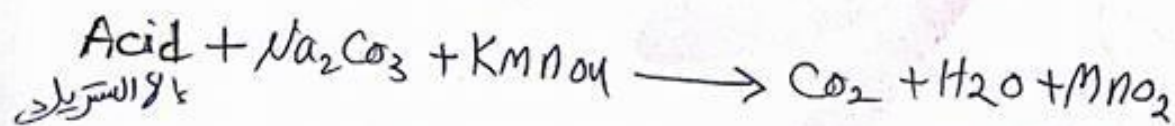
[3] $N-S + CaCl_2$

 $CaCl_2$ 1mL
N-S of acid obs. in table

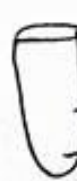


[4] $KMnO_4$ Test

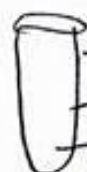
 $KMnO_4$ drops
 Na_2CO_3 (solid)
N-S of acid \rightarrow DeColorization

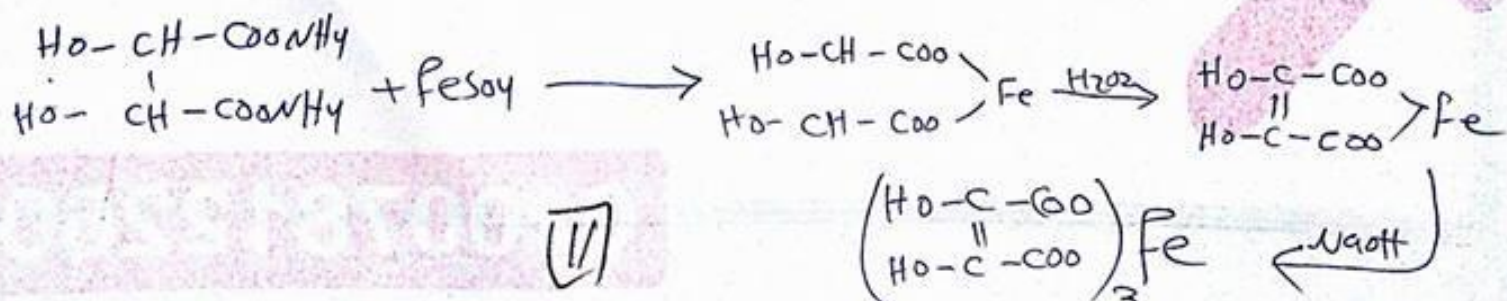


[5] H_2SO_4 + Solid Test

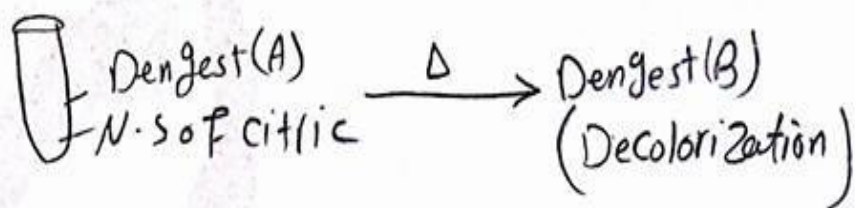
 conc H_2SO_4
~~acid~~
Solid $\xrightarrow{\Delta}$ $\begin{cases} \text{clear} \Rightarrow \text{oxalic} \\ \text{Black} \Rightarrow \text{tartaric} \\ \text{Yellow} \Rightarrow \text{Citric} \end{cases}$

[6] Fenton's Test كالا الستريك

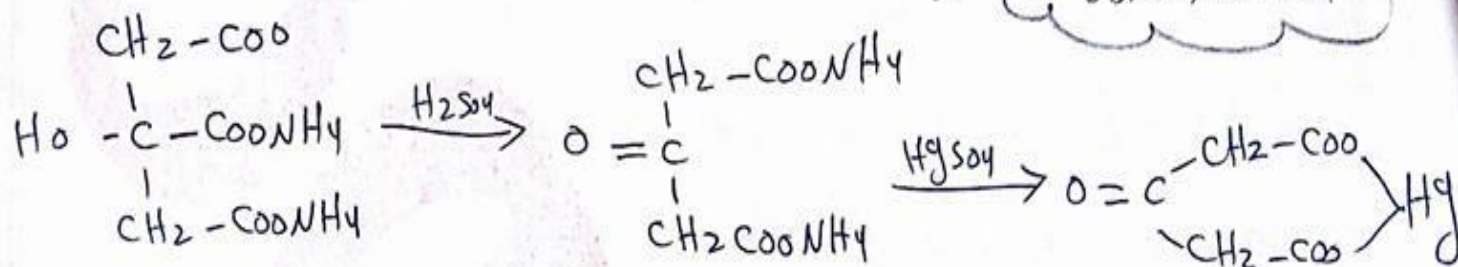
 H_2O_2 drop by drop
 $FeSO_4$
N-S of tartaric } Green \rightarrow colorless $\xrightarrow[\text{by drop}]{NaOH \text{ drop}}$ Violet



⑦ Denges Test اختبار دنجس



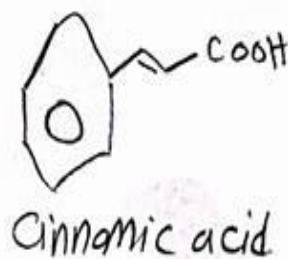
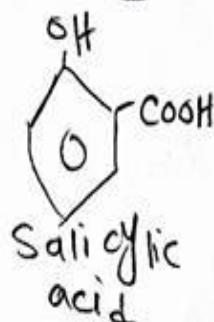
Dengest A \Rightarrow
 $HgSO_4 + H_2SO_4$
 Dengest B $\Rightarrow KMnO_4$



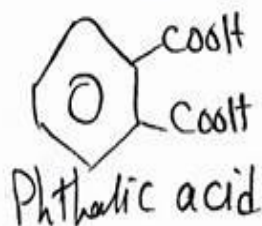
Identification of Aromatic Carboxylic acids Ar-COOH

* Classification according to the number of (-COOH) group

① Mono Carboxylic acid



② Di Carboxylic acid



* Physical Properties

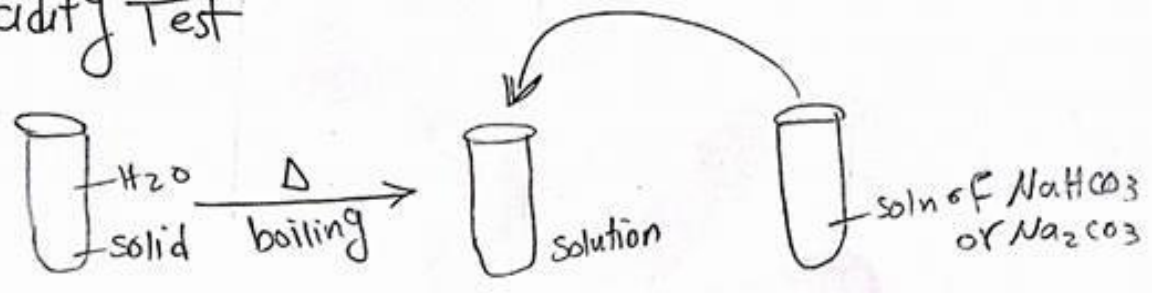
Color \Rightarrow white

Shape \Rightarrow crystal

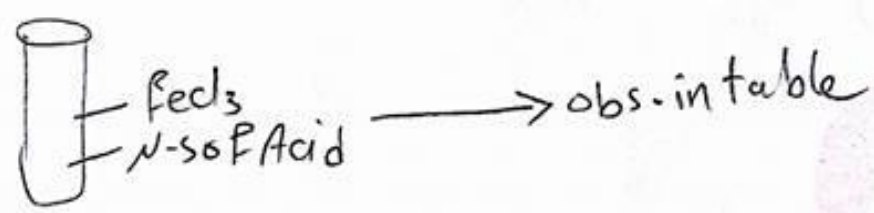
Solubility \Rightarrow insoluble in H_2O

compound	Benzoic	salicylic	Phthalic	cinnamic
Test				
1] Acidity Test	eff	eff	eff	eff
2] $FeCl_3$ Test	Buff PPT	Violet color	Buff PPT	Buff PPT
3] Phthaline Test	-ve	Pink color	Pink color	-ve
4] Azodye Test	-ve	Red PPT	-ve	-ve
5] unsaturation Test	-ve	-ve	-ve	Decolorization

1] Acidity Test

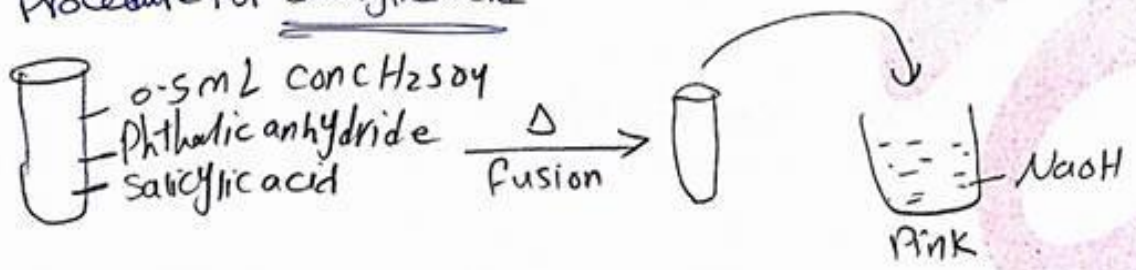


2] $FeCl_3$ Test

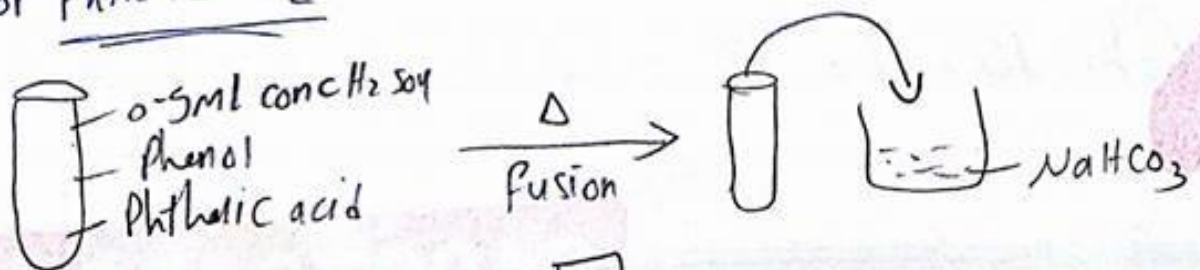


3] Phthalin Test.

Procedure for salicylic acid



For Phthalic acid



[4] Azodye Test نفس الخطوات من الفينول مع استبدال الفينول بـ Salicylic

[5] unsaturation Test

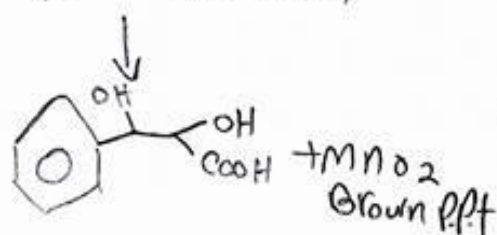
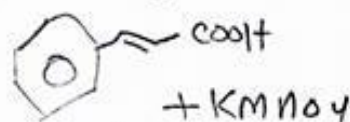
Detect the Presence of $(=)$ or (\equiv) rather than the aromatic system

Procedure

① $KMnO_4 / Na_2CO_3$

1 drop of $KMnO_4$
soln of Na_2CO_3
soln of cinnamic acid

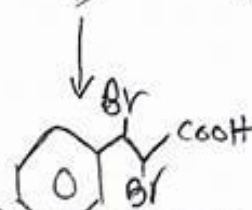
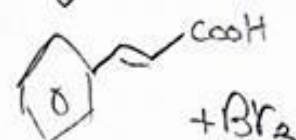
↓ decolorization



② Br_2 / CCl_4

1 drop of Br_2
 CCl_4
cinnamic acid (solid)

↓ decolorization



Scheme For Identification of Carboxylic acid

unknown acid

① solubility Test

soluble in H_2O
(Aliphatic acid)

Aliphatic acid
 $N.S + CCl_2$

insoluble in H_2O
(Aromatic acid)

white ppt at once
(oxalic)

white ppt after
scratching
(Tartaric)

white ppt
after boiling
(Citric)

clear

Conc H_2SO_4

↓
Yellow
Black

↓
Fenton's

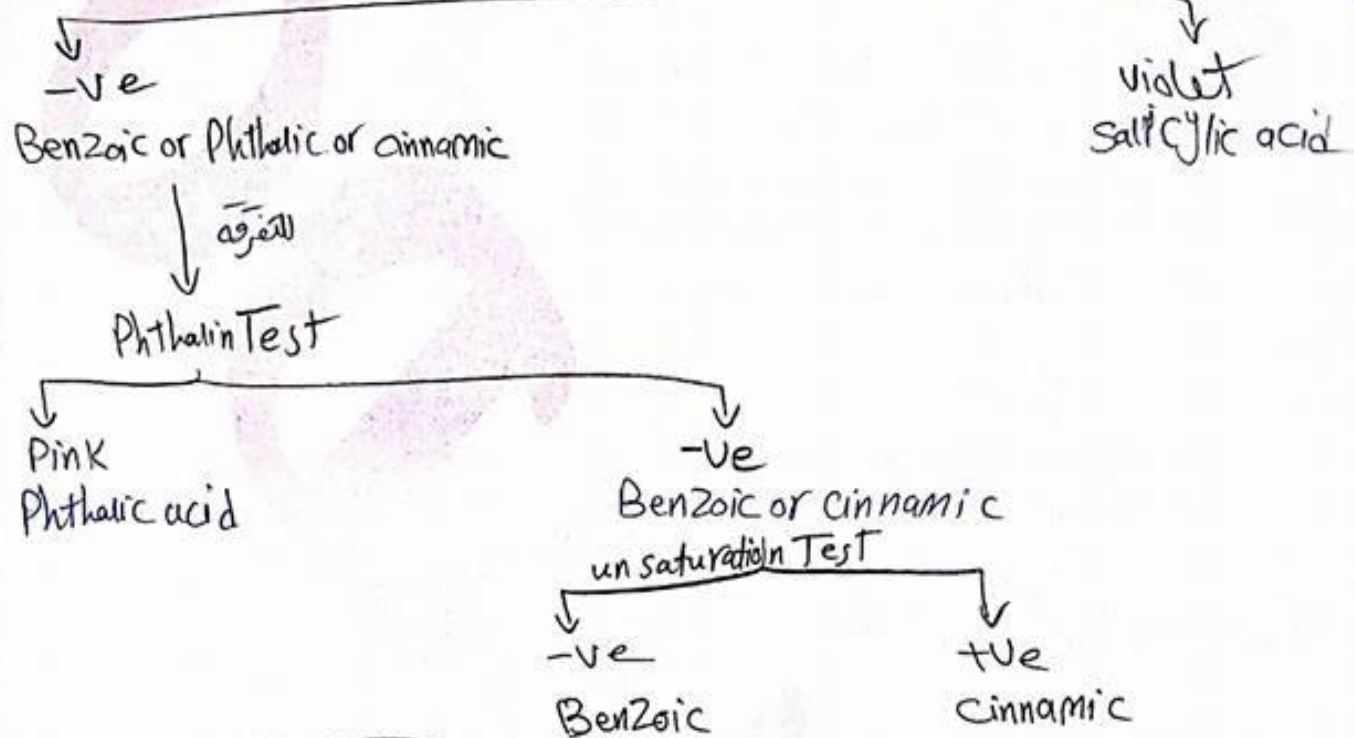
↓
Yellow

↓
Deng's Test

[14]

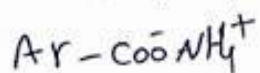
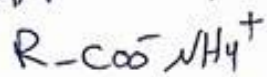
2] Aromatic acid

Soln + FeCl_3

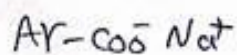
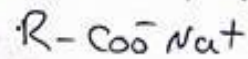


Identification of salt of acid

Ammonium salt of acid



Sodium salt of acid



Notes

- ① All salts of acid are solids
- ② All salts of acid are water soluble
- ③ All salts of acid give (-ve) acidity test

* Physical Properties

Color: white

Shape: Powder / crystal

Solubility in $\text{H}_2\text{O} \Rightarrow$ Soluble in H_2O

Scheme For salt of HCl

unknown salt

Solid + NaOH (40%)

Ammonia odour
↓
Amm. salt of Acid

No. Ammonia odour
↓
Sod. salt of acid

Soln + Conc HCl

No ppt
Ammonium salt of Aliphatic acid

White ppt
Ammonium salt of Aromatic Acid

Soln + CaCl₂

White ppt in cold
(Amm-oxalate)

White ppt after scratching
(Amm-tartrate)

White ppt after boiling
(Amm-citrate)

Solid + H₂SO₄ conc
↓
Fenton's Test

↓
Deng's Test

Soln + FeCl₃

Buff ppt
(Amm-Benzate, Phthalate, cinnamate)
Phthaline Test

Violet color
(Amm-Salicylate)

Pink color
(Amm-Phthalate)

-ve
(Amm-Benzate or cinnamate)

↓
unsaturation Test

+ve
(Amm-cinnamate)

-ve
(Amm-Benzate)

Notes

اسکیم اُملاح الصوديوم هي نفسها الامونيوم
مع استبدال المقطع Amm. بالمقطع Sod.
قبل تسوية كد ملاح